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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/763,244	01/26/2004	Taishi Kubota	8040-1052	8011
466	7590	01/25/2005	EXAMINER	
YOUNG & THOMPSON 745 SOUTH 23RD STREET 2ND FLOOR ARLINGTON, VA 22202			DANG, TRUNG Q	
			ART UNIT	PAPER NUMBER
			2823	

DATE MAILED: 01/25/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

**Application No.**

10/763,244

**Applicant(s)**

KUBOTA ET AL.

**Examiner**

Trung Dang

**Art Unit**

2823

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-10 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-10 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 26 January 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
- 1) ☒ Certified copies of the priority documents have been received.
  - 2) ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
  - 3) ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 3/31/04.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_.

## DETAILED ACTION

### *Claim Rejections - 35 USC § 102*

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) and the Intellectual Property and High Technology Technical Amendments Act of 2002 do not apply when the reference is a U.S. patent resulting directly or indirectly from an international application filed before November 29, 2000. Therefore, the prior art date of the reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

2. Claims 1-2, 4-5, and 9 are rejected under 35 U.S.C. 102(b) as being anticipated by Olsen (US 6,150,234).

With reference to Figs. 6-7, the prior art teaches the claimed invention in that it discloses a manufacturing method of a semiconductor device having an STI region in which a trench 51 formed in a semiconductor region by etching and an insulator 71 filled into the trench, the method comprising the steps of:

preparing dichloroethylene (DCE); and  
subjecting an inside the trench halogen oxidation with dichloroethylene  
whereby an angle of corner portion 42 of the semiconductor region adjacent to  
an opening upper end portion trench made rounder than the angle before the  
halogen oxidation (col. 2, lines 1-20; Fig. 6).

As for claims 2 and 5, Fig. 6 depicts the thickness of the oxide liner 61 at  
corner portion of the semiconductor region adjacent to an opening upper end portion  
of the trench is made greater than a thickness of the other oxide film in the trench.

2. Claims 1-3, 5, 8 are rejected under 35 U.S.C. 102(e) as being anticipated by  
Chang et al. (US 6,566,224).

With reference to Figs. 2D-2E, the prior art teaches the claimed invention in  
that it discloses a manufacturing method of a semiconductor device having an STI  
region 38 in which a trench formed in a semiconductor region by etching and an  
insulator 38 filled into the trench, the method comprising the steps of:

preparing dichloroethylene (DCE); and  
subjecting an inside the trench halogen oxidation with dichloroethylene  
whereby an angle of corner portion of the semiconductor region adjacent to an  
opening upper end portion trench made rounder than the angle before the  
halogen oxidation (col. 5, lines 1-19).

As for claims 2 and 5, since the silicon portions at the upper corner of the

trench are oxidized more than the other portions of the trench as shown in Fig. 2E, the thickness of the resulting oxide film at corner portions of the semiconductor region adjacent to an opening upper end portions of the trench are made greater than a thickness of the other oxide film in the trench.

As for claims 3 and 8, see col. 5, lines 16 for the concentration of DCE in an oxygen environment is about 1%.

***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 3, 8 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Olsen in view of Chang et al., both cited above.

Olsen teaches a manufacturing method of a semiconductor device having an STI region as described in the above 102 rejection.

Olsen differs from the claims in not disclosing the concentration of DCE in an oxygen environment within a range as claimed.

In the same field of endeavor, Chang teaches an oxidation process in which sidewalls of an isolation trench are oxidized in an oxidizing environment comprises DCE and oxygen, wherein the concentration of DCE in the oxygen environment is

about 1% (col. 5, lines 16-19).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Olsen's process by selecting the concentration of DCE in the oxygen environment of about 1% as suggested by Chang because it is known that oxidation in an ambient containing high concentration of HCl (produced by the chemical reaction of DCE and oxygen) produces facets, thus reducing the DCE concentration would have the benefit of rounding the trench corner while minimizing facets.

4. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Olsen as above in view of Chau et al. (US 5,891,809).

Olsen teaches a manufacturing method of a semiconductor device having an STI region as described in the above 102 rejection, including the teaching of using nitrogen as a dilute gas (see col. 3, lines 40-41).

Olsen differs from the claim in not disclosing that the DCE is introduced together with oxygen into the oxidizing furnace by bubbling nitrogen through liquid DCE.

Chau teaches an oxidation process in which the introduction of DCE into the furnace is carried out by bubbling nitrogen through liquid DCE (col. 3, lines 56-61).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Olsen's process by introducing the DCE into the

furnace using nitrogen as a carrier gas in the bubbling manner as suggested by Chau because such technique of introducing a reactant gas by bubbling an inert carrier gas through a liquid containing the reactant gas is known in the art, and the application of an old process to perform the same would have been within the level of one skilled in the art. Note that the nitrogen carrier gas is also a dilute gas because nitrogen is inert with respect to DCE.

5. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Olsen taken with Chau as applied to claim 6 above, and further in view of Chang et al as above.

The combined process of Olsen and Chau teaches a method as described above.

The difference between the combination and the claim is the concentration of DCE in an oxygen environment within a range as claimed.

In the same field of endeavor, Chang teaches an oxidation process in which sidewalls of an isolation trench are oxidized in an oxidizing environment comprising DCE and oxygen, wherein the concentration of DCE in the oxygen environment is about 1% (col. 5, lines 16-19).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Olsen's process by selecting the concentration of DCE in the oxygen environment of about 1% as suggested by Chang because it is known that oxidation in an ambient containing high concentration of HCl (produced by the

chemical reaction of DCE and oxygen) produces facets, thus reducing the DCE concentration would have the benefit of rounding the trench corner while minimizing facets.

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Trung Dang whose telephone number is 571-272-1857. The examiner can normally be reached on Mon-Friday 9:30am-6:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on 571-272-1855. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Trung Dang  
Primary Examiner  
Art Unit 2823

01/22/05

